Stevens Institute of Technology

A Graduate Program in

System Design and Operational Effectiveness (SDOE)

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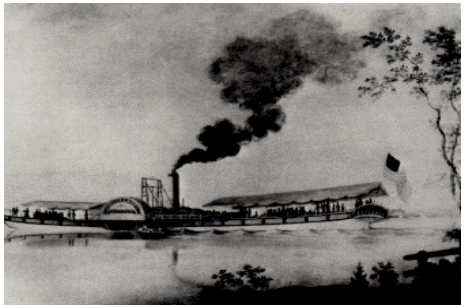
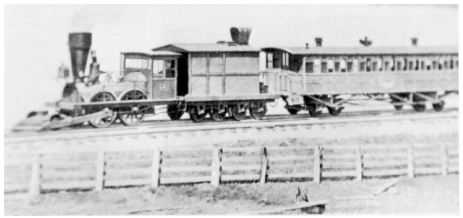
Stevens Institute of Technology:
Historical Perspective

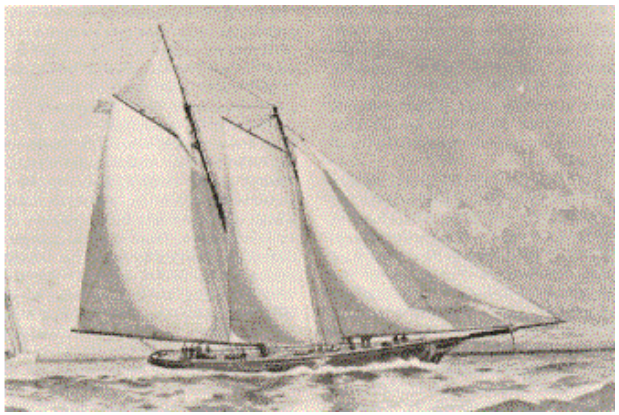




- **Col. John Stevens III (1749-1838)**
  - Treasurer of NJ in Revolutionary War
  - Bought land that became Hoboken after the War
- **With second son Robert Livingston Stevens, pioneered steam transportation**
  - Many innovations for steam boats;
  - First U.S. steam locomotive
    - Robert invented the T-rail and the cow-catcher
  - Helped pass first U.S. patent laws
- **Stevens Family - Transportation Pioneers**
  - First steam railroad, Perth Amboy to Camden, NJ
  - *Phoenix*, the first steamship to make an ocean voyage

Stevens Institute of Technology:
Historical Perspective

- Founder of the Institute: Edwin A. Stevens
  - 1795 - 1868
  - Third son of Colonel John
  - Founded Institute in 1871
  - Stevens family made fortune in transportation: toll roads, ferries and railroads



- John Cox Stevens, first son of Col. John, founded the N.Y. Yacht Club
- John and Edwin sailed the *America* in the first race of what became the America's Cup International Challenge Races (they won)
- Davidson Laboratory has tested many designs for America's Cup

Stevens Institute of Technology:
Educational Programs

- Average Incoming Freshman GPA: 3.8
- Average SAT Score: 1340 Cumulative
- 40% of Student Participate in Cooperative Education Program
- 23% of Students are Female
- Students Represent 20 States and 20 Countries
- 95% Placement Rate (Job or Graduate School)
- Top Employers:
  - DoD
  - IBM
  - PSEG
  - Merck and Company, Inc.
  - Solomon Smith Barney
  - Chase Manhattan
  - Lucent Technologies
  - Exxon
  - Lockheed Martin
  - Arthur Andersen

Stevens Institute of Technology:
Educational Programs

STEVENS Institute of Technology

- 1600 undergraduates; 1500 graduates FTE
- Wesley J. Howe School of Technology Management
  - Master's in information systems, telecommunications management, … (50%); Ph.D. in selected areas
  - Bachelor's in Business and Technology (2000)
- School of Applied Sciences and Liberal Arts
  - Undergraduate programs in the sciences (30%)
  - Master's and Ph.D in the sciences (23%)
- Charles V. Schaefer, Jr. School of Engineering
  - 7 undergraduate programs (70%)
  - Master's and Ph.D (27%)

Stevens Institute of Technology:
The Design Spine in the School of Engineering

STEVENS Institute of Technology

- Design is at the heart of engineering
- A design course is given each semester
  - Hones problem-solving skills
  - Provides hands-on experience
  - Taught by faculty, professional engineers and peers
- Engineering Science courses are integrated with Design courses
- The Design Spine is the vehicle to develop key competencies in the “soft” areas
- State -of -the-art laboratories
- Information Technology integrated throughout

Stevens Institute of Technology:
Technogenesis™

- The educational frontier wherein faculty, students, and industrial colleagues jointly nurture the process of conception, design and marketplace realization of new technologies
- Technogenesis™ will chart the directions of the Institute over the next decade:
  - Re-engineer educational programs to promote education rooted in technogenesis
  - Re-invent the Ph.D. program with a focus on the realization of technology in the market place
  - Promote multi-disciplinary research and the exploitation of intellectual property

The System Design and Operational Effectiveness Program

Technogenesis™:
Attributes of Students

STEVENS Institute of Technology

- Innovation/Imagination
- Independence/Self-reliance
- Entrepreneurship
- Business Practice
- Understand the Interaction of Social and Technological Forces that Shape the World
- Networking Attitude

System Design & Operational Effectiveness (SDOE) Program

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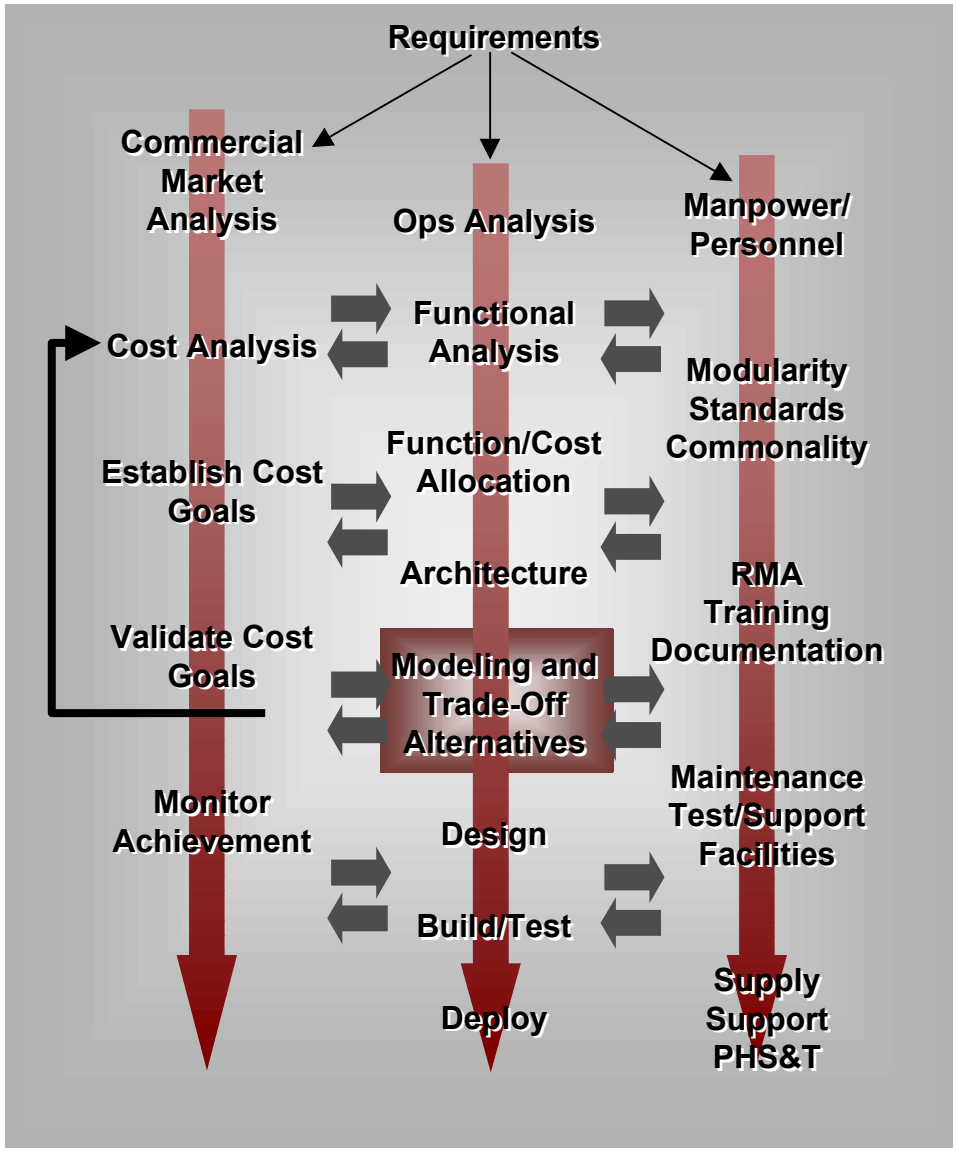
- **Numerous Systems Engineering Programs Exist, However:**
  - **Address Process, Methods, Tools, Modeling and Simulation**
  - **Confuse Systems Engineering with System Analysis or Science**
  - **Select Few Address Issues Pertaining to Design for Manufacturability; Design for Assembly**
  - **Fewer Still Address Reliability Engineering - This is often addressed in Operations Research or Industrial Engineering**
- **Numerous Logistics Programs Exist in the United States:**
  - **Address Business Logistics (Distribution, Warehousing, Supply Chain Management, Transportation)**
- **There is Need for a Graduate Degree and Certificate Program that Addresses Supportability Engineering and Logistics in a Systems Engineering Context**

The SDOE Program Focuses on the Interface Between:

Customers  **Contractors**

The SDOE Program:
Systems Engineering and Analysis

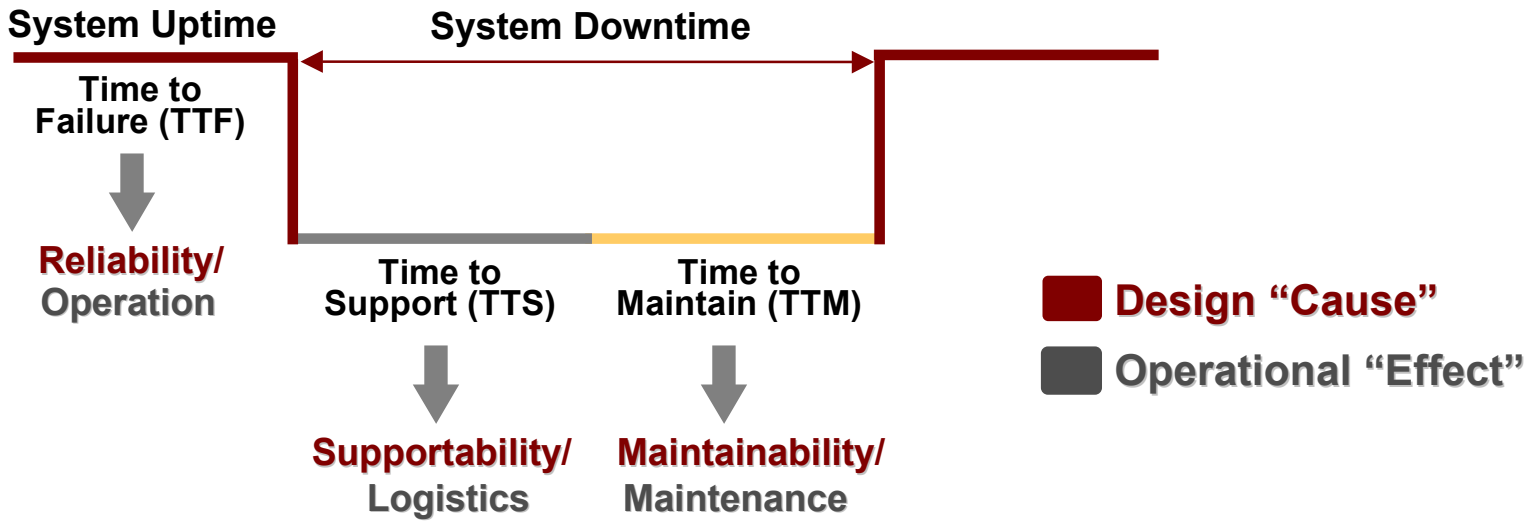


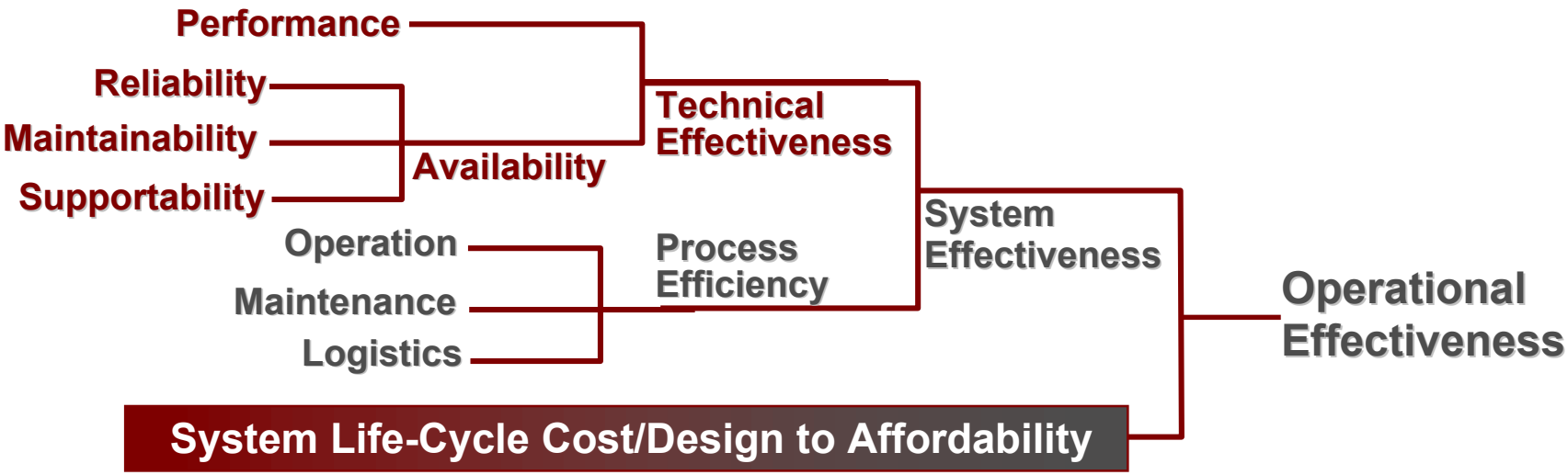
...translation of a need/deficiency into a **system architecture** through the iterative process of functional analysis, allocation, implementation, optimization, test, and evaluation;

...incorporation of technical parameters to assure compatibility between physical & functional interfaces, hardware & software **interfaces**, in a manner that optimizes system definition and design; and

...**integration** of performance, manufacturing, reliability, maintainability, supportability, global flexibility, scaleability, upgradeability and other specialties into the overall engineering effort.

The SDOE Program:
System Operational Effectiveness





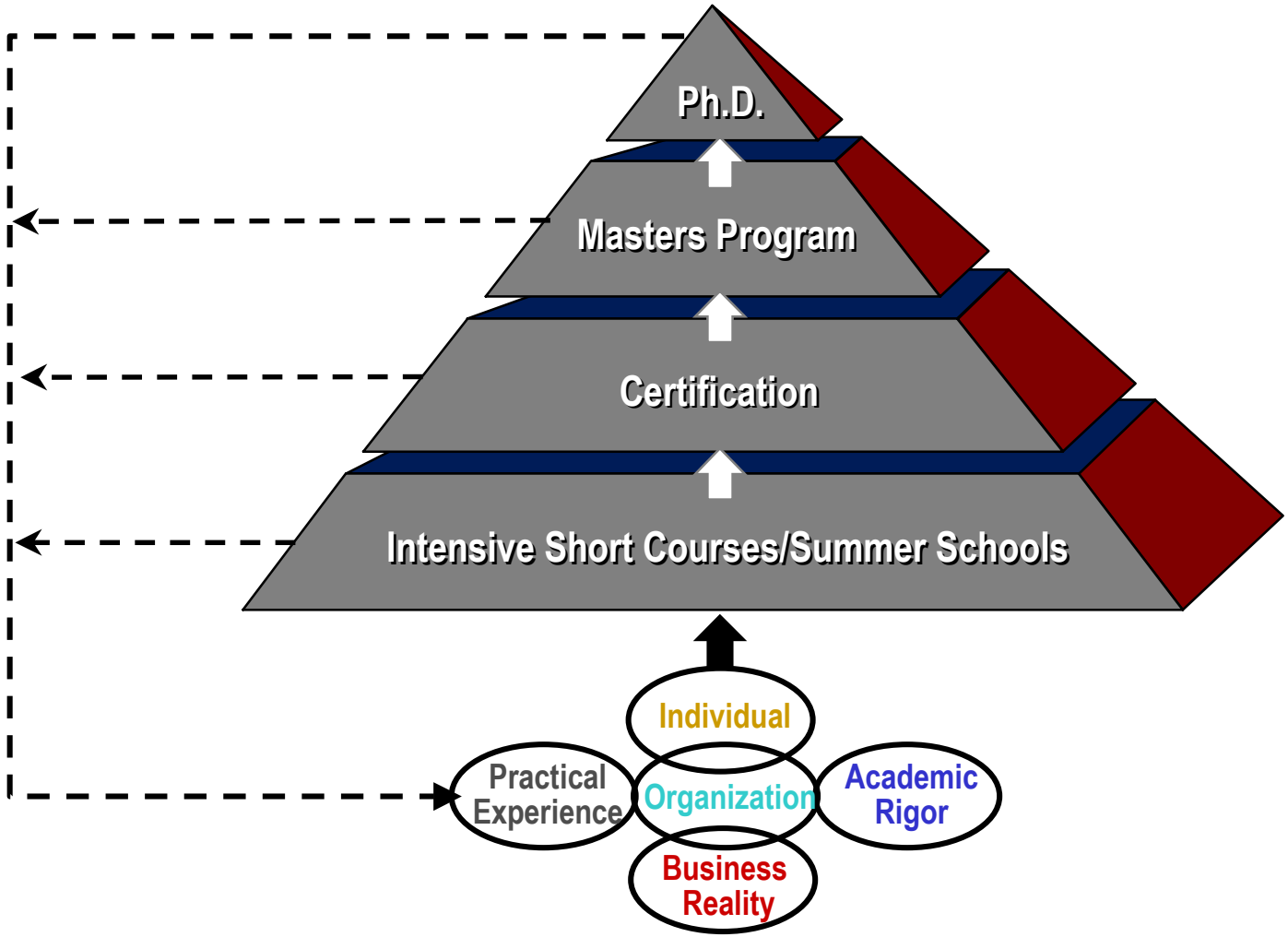
The SDOE Program:
Vision

STEVENS Institute of Technology

A Multi-disciplinary, Industry-focused, Project-based Educational Program

Systems are viewed to encompass both the product and the operational and support processes together, as both are essential for the delivery of required functionality, and the ultimate satisfaction of customer needs

The SDOE Program:
Educational and Training Components



The SDOE Program:
An Over-Arching Schematic

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Business and Program Realities
Application of IT and Multi-Media for an Enhanced Educational Experience
Currency with On-Going Technology Evolution

- **Candidates** with a Bachelor's Degree
- **Organizations (System Integrators; System Users, Operators, Maintainers)**

System Design and Operational Effectiveness (SDOE) Program

- **Future Systems and Supportability Engineering and Logistics Leaders**
- **Competitive, Effective, and Efficient Organizations**

Academic Rigor and Discipline
Pragmatic and Experienced Instructors
Case and Project-based Learning in a Team Environment
Programmatic Flexibility and Portability

The SDOE Program:
Education - Master's and Certificate

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Certification Program		Total Credits		Graduate Program
	15		30	
		Core Credits		
System Design & Operational Effectiveness	6		12	System Design & Operational Effectiveness
		Elective Credits		
	6		12	
		Project Credits		
	3		6	

Reliability and Durability
Supportability and Logistics
Maintainability and Maintenance

Reliability and Durability
Supportability and Logistics
Maintainability and Maintenance

The SDOE Program:
Education - Master's and Certificate

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- **Core Courses:**
  - System Operational Effectiveness & Life-Cycle Analysis
  - Integrated Product Development I
  - Project Management
  - Modeling & Simulation/Analytic Tools & Techniques
- **Selected Electives:**
  - Design for Reliability, Maintainability, and Supportability
  - Reliability and Durability
  - Maintainability and Maintenance
  - Supportability and Logistics
  - System and Software Architecture and Design
  - Organizational Behavior and Theory
  - Integrated Product Development II
  - Life Cycle Cost and Economic Analysis
  - E-Commerce

- **Admission Requirements:**
  - Bachelor's Degree
- **Instructional Media and Instructors:**
  - Balanced Approach (Rigor and Experience):
    - Industrial Fellows
    - Academic Fellows
  - Flexible Delivery:
    - Project-based Learning
    - Entirely Web-based Courses
    - Intensive Week-long Modules

The SDOE Program:
Focused on the Complex Systems of the Future

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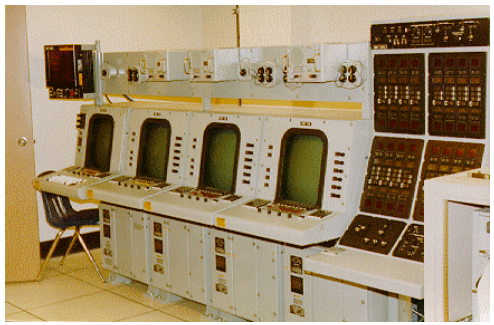
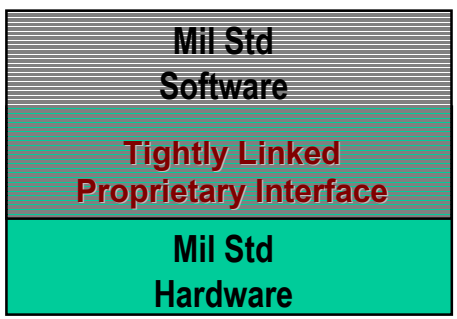
Past



- Mil-Spec Hardware and Software for Computing Infrastructure
- Closed/Proprietary Architecture/ Interfaces
- Mission Capabilities Created By the Combination of Unique Software and Hardware



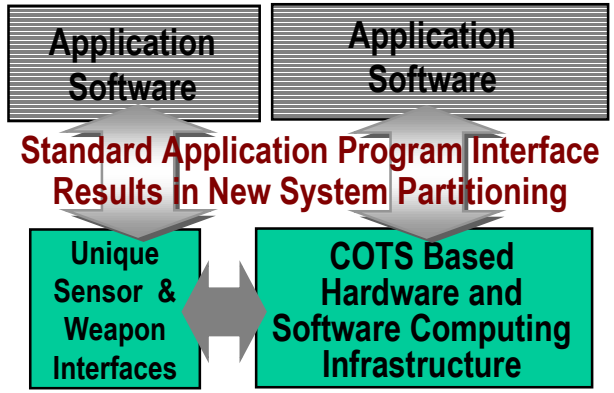
Present

75% COTS

5:1 Reduction in Cost

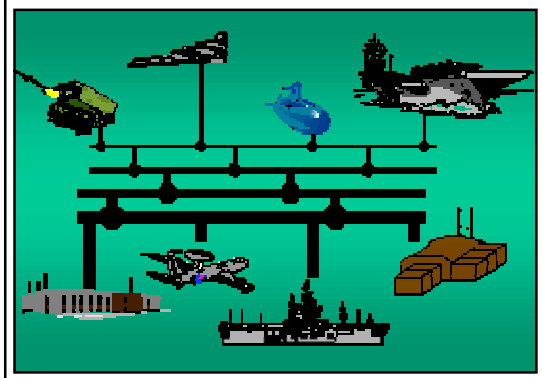
100X Increase in Throughput

- Commercially Available Technologies for Computing Infrastructure
- Open Architecture Using Commercial Standards for Interfaces
- Mission Capabilities Created By Reliable, Dependable, Durable Software Applications



Future

- Extend Open Standards to Focus on Interoperability (Net-Centric)
- Utilize High Throughput of Commercial Technologies to Address Automation and Supportability
- "Smart" Software



The SDOE Program:
Research - Vibrant and Evolving Program

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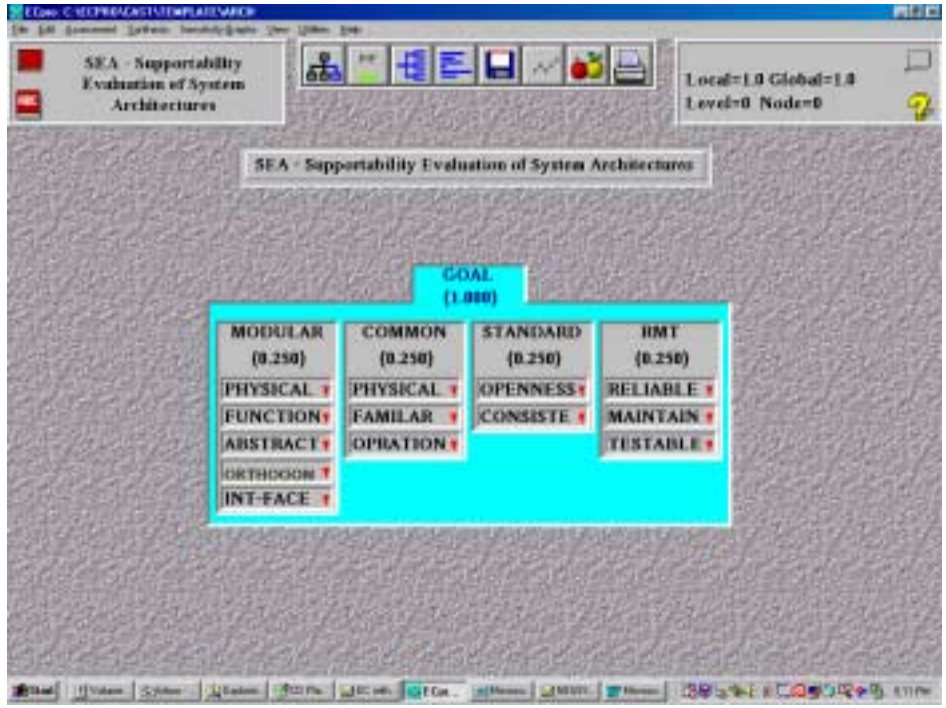
- **Evaluation and Assessment of System Architectures**
- **Assessing the Capability of Organizations to Execute Full Service Contracts**
  - **Assessment of Risk - Identification of Metrics**
  - **Framework to Facilitate Cost Benefit Analysis**
- **Development of Metrics and Measures of System Operational Effectiveness**
- **Simulation Environment for Integrated System Design and Operational Effectiveness**
- **Conversion of Military Specifications to Performance Specifications and Criteria**
- **Strategies for Addressing Diminishing Manufacturing Sources**

Evaluation and Assessment of System Architectures - Information Processing



- **Initial Support Provided by: The Aerospace Corporation; George Mason University; Lockheed Martin, Kongsberg Defense and Aerospace; and Boeing.**
- **Funding in Place from Lockheed Martin and United Defense to do the Initial Validation of the Model, in Partnership with the University of Virginia.**
- **Strong Interest from NOKIA and Ericsson - Presentation at the NOKIA Research Center scheduled for February 7, 2001.**

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Research - Vibrant and Evolving Program

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The SDOE Program:
Identification of Best Practices and Metrics

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- Lead Institution: SDOE Program, Stevens Institute
- Partners: Virginia Tech (Sub-Contract Relationship); MIT - Lean Sustainment Initiative (Data Sharing)
- Support Also Being Provided by:
  - The Systems and Supportability Interface Research Working Group, INCOSE
  - The Systems and Supportability Working Group, SOLE-The International Society of Logistics
- Project is Focused on Commercial Best Practices and Metrics for System Maintenance, Training and Supply Support in the Information Processing, and Command and Control Domain:
  - Survey Constructed and Mailed to 8,000 people World-Wide
  - 300 Responses Thus Far
  - Initial Study to be Published in February, 2001

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